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The Basics

Introduction

The MFJ-495 Memory Keyer is a full-featured memory keyer combining a microprocessor and a non-volatile EEPROM chip for a full featured, low cost, high reliability design. Unlike other keyers, it uses a LCD display to set keyer functions and show the sending message. The MFJ-495 keys CW from a paddle, a keyboard and a serial computer interface. All code parameters are changed with an easy to use menu interface shown on the LCD display. The MFJ-495 has 32 message memories totaling over 8000 characters that can be loaded by paddle, by keyboard, or from a computer with a terminal program. The MFJ-495 can repeat messages continuously, insert timed pauses within messages, insert an auto-incrementing serial number, have messages call other messages or insert command mode commands into a message with embedded message commands. Commands also can be simply sent to the keyer in Morse code using your paddles, keyboard, terminal program on your computer, or push-button switches on the unit.

The MFJ-495 has controls for volume and speed on the front of the unit. The paddle jack connects to any iambic or single lever (dual contact) key paddle. The keyboard port allows use of an optional keyboard for keyboard keying operation. The serial interface allows for the connection of most RS-232 compatible computers. The MFJ-495 supports both Direct and Grid-Block outputs and has a port for an optional remote control. Some of its features:

- 2-line, 16-character LCD display
- Iambic keyer with dot and dash memories; automatic, semi-automatic or hand-key mode
- 32 messages (four banks of eight messages each) totaling over 8000 characters
- Messages may “call” other messages and contain programmed functions
- Message editing capability
- Input queue to store multiple message activation
- Auto-incrementing contest serial number from 001 to 9999
- Digital and linear analog speed control from 5 to 99 WPM (3:1-to-20:1 speed range ratio)
- Farnsworth mode with speed from 10 to 99 WPM
- Ultra speed mode allows messages at speeds up to 990 WPM
- Adjustable weight on code elements from 25% to 75% (constant or speed dependent)
- Adjustable sidetone frequency from 300 to 1000 Hz
- Compensation for transmitter character shortening up to 25 ms
- Keying output delays up to 20 ms to accommodate switching delays
- Push-to-talk (PTT) hang time for up to 10 seconds
- Direct (positive) or grid-block (negative) keying
- Carrier tune and adjustable pulse tune functions for transmitter adjustment
- Timed pauses within messages and message loop capability for continuous replay
- Message and keyer configuration is saved without battery backup
- Internal sidetone speaker with adjustable volume
- Support for Qwerty and Dvorak keyboards with RepeatKey feature
- 190 characters type-ahead keyboard buffer with buffer-full warning
- Quad user mode supports operators with different configuration settings

Front Panel

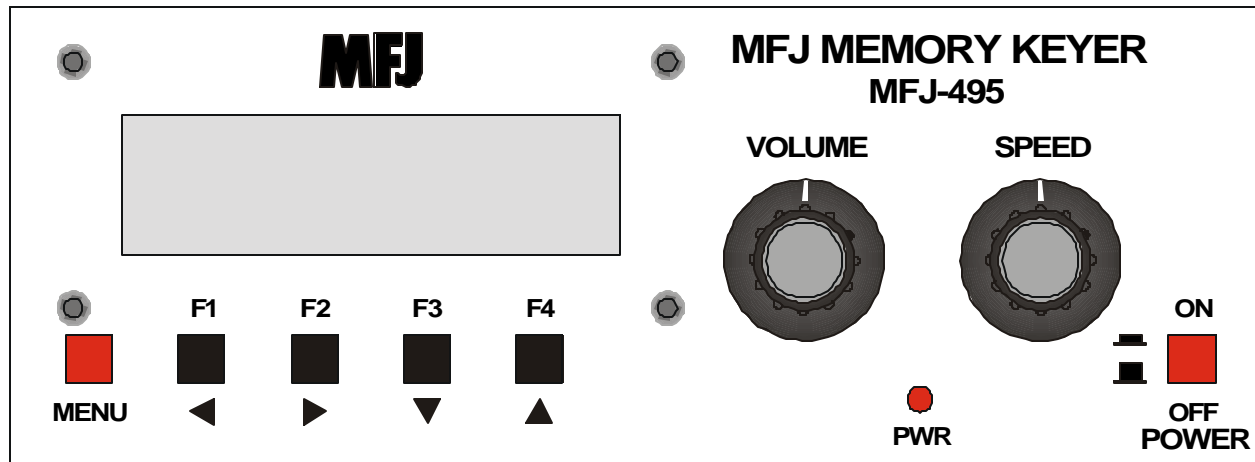


Figure 1. MFJ-495 Front Panel

- **LCD Display:** A 2-line, 16-character LCD that displays the keyer's various menus and the code being sent.
- **Menu Button:** The Menu button is time-sensitive and is used to navigate through the various menus and to enter or exit the setup menus.
- **Function Buttons:** The general-purpose Function buttons F1 to F4 perform the operations displayed on the LCD above each corresponding buttons. They also navigate through the setup menus as well as change the keyer settings within the setup menus. These buttons are also time-sensitive.

Note: The F1 to F4 on the MFJ-495 will be referred to as "button" and the F1 to F4 on the keyboard will be referred to as "key" throughout this manual.

- **Volume Control:** The Volume control adjusts the sidetone audio volume to the internal speaker and Audio Out jack. Turn the control clockwise to increase the volume and counter-clockwise to decrease the volume.
- **PWR LED:** The PWR LED illuminates when the power to the unit is on. It also blinks when the keyer is in message program mode.
- **Speed Control:** The Speed control varies code speed in a 3:1-to-20:1 ratio within the range of 5 to 99 WPM. Turn the control clockwise to increase speed and counter-clockwise to decrease speed.
- **Power Button:** The Power button turns the unit on and off. Press in to turn power on; press again (out) to turn power off.

WARNING: Do not turn the power on and off rapidly, otherwise the memory (keyer settings) would be corrupted and the unit will have to reset to factory defaults to function properly.

Back Panel

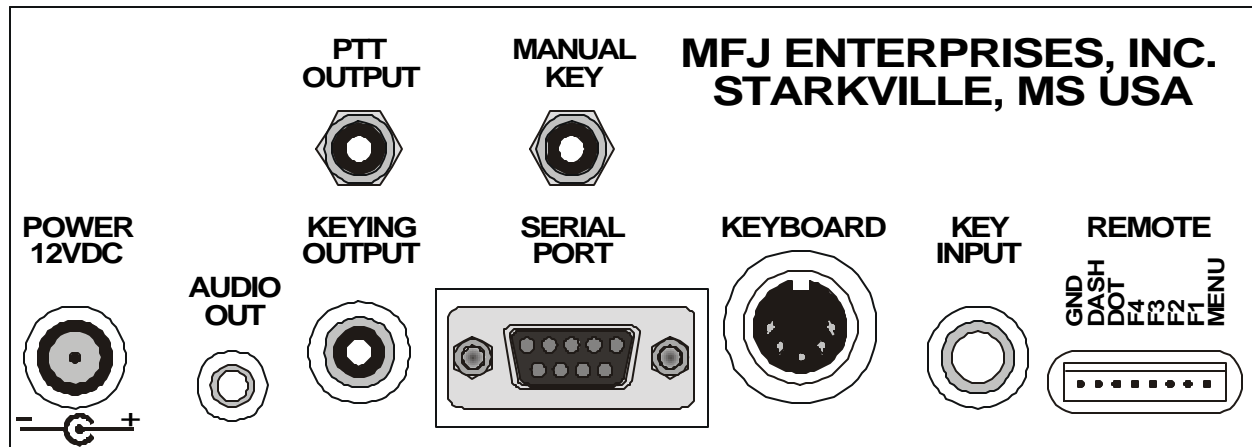


Figure 2. MFJ-495 Back Panel.

- Power:** The Power jack accepts a 2.1mm coaxial plug with positive center and negative sleeve. This unit requires 12 volts DC. An optional power supply, the MFJ-1315, is available from MFJ Enterprises, Inc. This unit requires a minimum of 500 mA and a maximum of 300 mA at maximum volume into an 8-ohm audio load. It may require more current depending on the type of keyboard used; typical keyboard uses about 100 mA.

WARNING: Do not apply voltages greater than 18 volts to this unit. It can cause permanent damage to the unit.

- Audio Out:** The Audio Out is a 3.5mm stereo phone jack used for connecting the unit to an external speaker or headphones. This jack accepts both stereo and mono plugs. When this jack is used, the internal speaker is disabled. An optional external speaker, the MFJ-281, is available from MFJ Enterprises, Inc.

WARNING: To prevent hearing damage when using headphones, turn the Volume control to minimum before putting on the headphones and then slowly adjust for a comfortable volume.

- PTT Output:** The PTT Output is an RCA jack providing connection for a PTT (push-to-talk) output that goes low when active. This jack is an open-drain output; an external pull-up can be used if so desired. Use a quality-shielded cable for connection to this jack.

- Keying Output:** This unit supports both positive and negative keyed radios. Use a quality-shielded cable for connection to this RCA jack. Consult your transmitter's manual to determine if it uses direct (positive) or grid-block (negative) keying.

Two jumpers JMP1 and JMP2 inside the unit set the keying output to direct for

JMP1	JMP2	Keying Output
D	D	Direct *
D	G	Invalid
G	D	Invalid
G	G	Grid Block

Table 1. Keying Output Jumpers.

positive keyed radios (most solid-state radios) or to grid-block for negative keyed radios (most radios with tube finals). Set both jumpers to the “D” positions for direct keying or to the “G” positions for grid-block keying. If they are set wrong, the transmitter will either not key at all or key continuously. The factory default * is direct keying output.

- Manual Key:** The Manual Key is an RCA jack providing an input line for manually keyed devices, such as a straight key or a computer interface. An internal jumper JMP3 configures this jack to accept active-low (for straight key) or active-high (output from computer software) input. Set this jumper to the “L” position for active-low input or to the “H” position for active-high input. If it is set wrong, the keyer will key continuously. The factory default * is active-high.

JMP3	Manual Key
L	Active Low
H	Active High *

Table 2. Manual Key Jumper.

- Serial Port:** The serial port on the back of the unit accepts a standard 9-pin serial plug for connecting the MFJ-495 to a computer for ASCII file transfers or monitoring your sending on the computer screen. A 9-pin-to-9-pin serial cable is needed. If your computer has a 25-pin serial port, use a 9-pin-to-25-pin adapter.

To communicate with the MFJ-495, use a terminal program on your computer that is capable of transferring information in ASCII format. Configure the software for 1200 baud, 8 data bits, 1 stop bit and no parity; set the flow control to Xon/Xoff.

- Keyboard:** The keyboard port accepts most standard AT style keyboards (XT keyboard does not work with the MFJ-495). The MFJ-551 keyboard is guaranteed to be fully compatible with the keyer and available from MFJ Enterprises, Inc.

The two jumpers, JMP4 and JMP5, inside the unit configure the keyboard operation. Jumper JMP4 selects whether a Qwerty or Dvorak keyboard is used; place this jumper on the “L” position for Qwerty keyboard or on the “H” position for Dvorak keyboard. Jumper JMP5 set the RepeatKey feature that selects whether or not to repeat a key when it is held down; place this jumper on the “L” position to disable RepeatKey or on the “H” position to enable RepeatKey. The factory defaults * are Qwerty keyboard and RepeatKey off.

JMP4		Keyboard Layout
L		Qwerty *
H		Dvorak
	JMP5	RepeatKey
	L	Off *
	H	On

Table 3. Keyboard Jumpers.

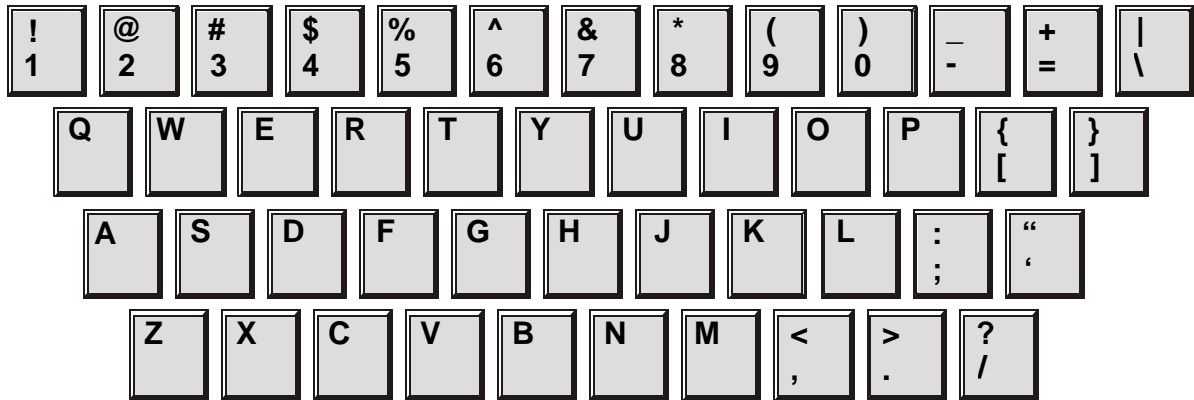


Figure 3. Qwerty Keyboard Layout.

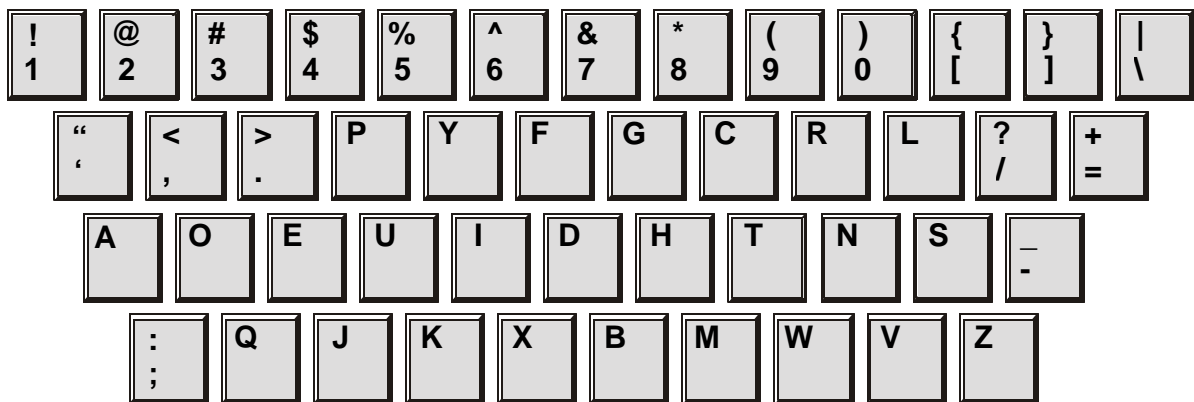


Figure 4. Dvorak Keyboard Layout.

- Key Input:** The Key Input jack is a ¼inch stereo phone jack. An iambic or single lever (dual contact) paddle with a shielded cable should be used. When used with paddles, the dot wire should be connected to the tip of the plug, the dash wire to the ring, and the ground wire to the shield.
- Remote Port:** The last port in the back of the unit is for the optional remote control. The remote control gives you remote access to the keyer menu if the main unit is out of reach. The remote has the menu and function buttons as well as the paddles connections and mounts on your Bencher type or MFJ-564 Paddle. The remote connector combines both the remote functions and the paddle jack so that only one cable from the paddle to the keyer is needed.

Connecting to a Computer

You may connect the MFJ-495 to a computer using the 9-pin DIN serial port on the back panel. If your computer has a 25-pin serial port, you can use a 25-pin-to-9-pin adapter.

To use a computer with the MFJ-495, run a terminal program that will upload and download ASCII files, and configure the terminal program to do so. Set the terminal program for 1200

baud, 8 data bits, one stop bit and no parity; set the flow control to Xon/Xoff. If you see extraneous linefeeds on the computer screen when receiving data from the MFJ-495, you may configure your software to strip out these extra linefeeds.

During sending, the characters sent by the MFJ-495 are sent through the serial port, so you may use your computer to monitor the transmitted copy. You may find this particularly convenient.

You also may upload and download text files between the MFJ-495 and your computer. For details on this, see the discussion of XXX on page XX.

Basic Operation

The Memory Keyer is simple to operate. The Power button controls power to the unit. Start sending with a paddle or keyboard. Adjust the volume and speed to your preference. If the speed is still too fast or too slow, adjust the range of the Speed control using the Speed command.

All characters or code sent by the user are played on the sidetone speaker. This allows the user to hear what he is keying, typing, or sending with a computer. Only when the keyer is used with a paddle is the code sent as soon as it is keyed. When using a keyboard or keyer terminal, you may type ahead of the code that is being transmitted. This allows you to enter words and phrases faster than the transmitted code. This permits smoother code with less pauses because you can fix misspelled words and think of the right phrase to use while your previous sentence is being sent.

When you are in command mode, memory save, or configuration mode, the code sent to the speaker is not sent to the key output or your radio. This keeps all erroneous code off of the air.

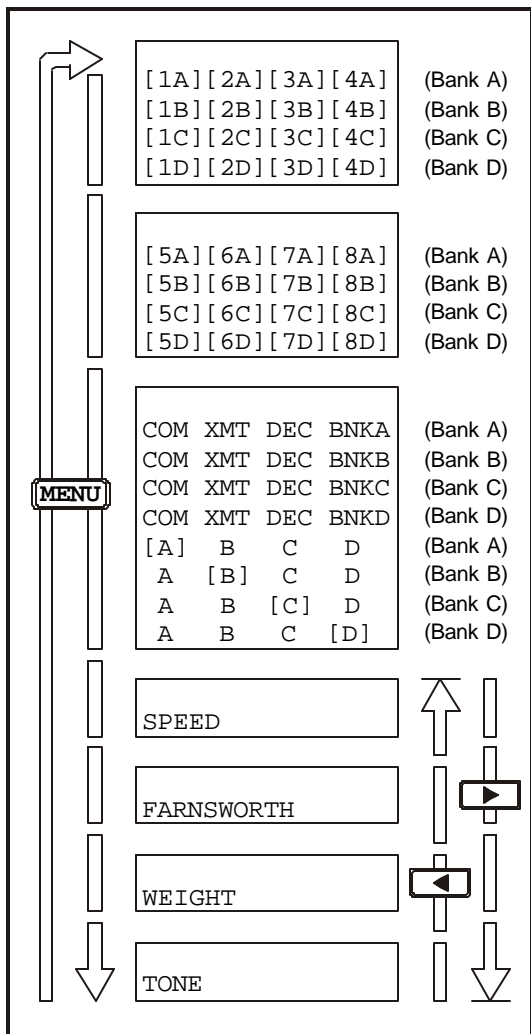
Getting Started: How to Use the Menu System

You may set up the MFJ-495 to perform any of its many functions by making the appropriate selections from its menu system. This system consists of 7 main menus and 22 setup menus. Make your selections by using the five buttons under the LCD display – Menu, F1/Previous □, F2/Next ✕, F3/Down ▢, and F4/Up ✱. These buttons do the following:

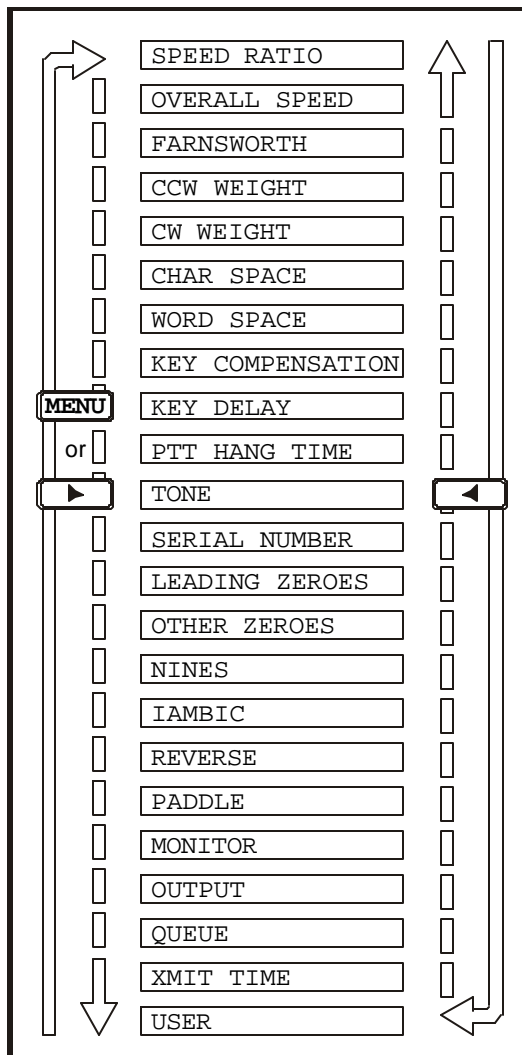
- Menu – Scrolls through the main and setup menus when pressed briefly. To enter the setup menu, press and hold this button for two seconds. To exit the setup menu and go back to the main menu, press and hold this button for two seconds.
- F1/Previous – Selects the main menu command or the previous setup menu
- F2/Next – Selects the main menu command or the next setup menu
- F3/Down – Selects the main menu command or the previous item in a setup menu
- F4/Up – Selects the main menu command or the next item in a setup menu

MENU BUTTON FLOW CHART

MAIN MENUS



SETUP MENUS

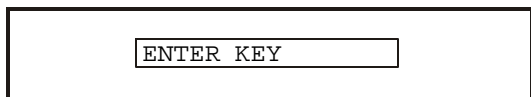


For 2 sec.

For 2 sec.

For 2 sec.

For 4 sec.



BUTTON ACTION

Press to navigate menus.

Press to go to previous menu.

Press to go to next menu.

Press to decrease setting.

Press to increase setting.

Figure 5. MFJ-495 Menu Flow Chart.

The main menus are arranged in a "wrap-around" structure, so that momentarily pressing the Menu button will bring up another main menu in a sequence. Figure 5 shows the sequence of the main menus. When power is turned on, the main menu displayed is the one that was displayed when the unit was last turned off.

The setup menus are also arranged in a "wrap-around" structure, so that pressing the Previous or Next button will bring up another setup menu in a sequence. Momentarily pressing the Menu button will also bring up the next setup menu. Figure 5 shows the sequence of the setup menus. When entering the setup menus, the setup menu displayed is the one that was last used.

To see how the setup menu system works, consider the following example.

EXAMPLE: To enter the setup menu, press and hold the Menu button for two seconds. If the display shows that you are in the Overall Speed menu, pressing the Next button will put you in the Farnsworth menu and pressing the Previous button will put you in the Speed Ratio menu. Pressing the Down or Up button will lower or raise the overall code speed. Once you have selected the speed you desire, you may leave the setup menu by pressing the Menu button again for two seconds, or the Previous or Next button to go to another setup menu.

Once you have made your choices within the setup menus, they will be saved in non-volatile memory for your next session.

Using the MFJ-495 with a Paddle

Plug an iambic or single lever (dual contact) paddle into the Key Input jack of the MFJ-495. Begin sending code using the paddles. If you would like to change speed, sidetone or weight, see the sections pertaining to the commands.

The iambic paddle has a unique feature that the single lever paddle does not have. Notice that the two paddles are independent, but they can be squeezed together. Both the dot and dash contacts touch the chassis, therefore ground. The MFJ-495 senses this happen and uses it as a separate keying mode. When you squeeze the paddles the keyer will automatically alternate sending code elements, dashes and dots. This is called iambic keying.

Iambic keying has two modes: A and B. In iambic A mode, the keyer will stop sending as soon as you release the paddles. In iambic B mode an extra element, either dot or dash is sent when the paddle is released.

<p>Note: It is recommended that the Farnsworth mode be disabled when sending with a paddle. When Farnsworth mode is enabled, the keyer will send code at the Farnsworth speed, not the overall speed.</p>
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Using the MFJ-495 with a Keyboard

When you plug in a standard IBM style AT keyboard, your keyer becomes a powerful keyboard keyer. The MFJ-495 uses the letter keys A-Z, the number keys 0-9, the function keys F1-F12, the space bar, the arrow keys, and the punctuation characters that have Morse equivalents. Prosigns have been assigned to some of the other punctuation characters for quick operation. See the table in the appendix.

The operation of the keyboard is simple. Begin typing on the keyboard. Typed characters are sent at the code speed of the keyer. If a typing mistake occurs, the BACK SPACE key can be pressed to erase the last character *before* it is sent. If you want to purge all the text in the buffer that has not yet been sent, press the ESC key. Pressing PAUSE during transmission stops playback of the buffer text and allows entry with the paddle; press ESC *once* to resume playback of the buffer text from where it was interrupted.

When typing speed is greater than the code speed, characters will begin to fill a type-ahead buffer. The code sent to the radio and over the sidetone speaker will lag behind the typing of each character. Most of the time this will not cause a problem. Only for very fast typists that send slow code will the type ahead buffer fill significantly. The maximum size of the type-ahead buffer is 190 characters. When the buffer fills to 180 characters the sidetone will be higher. This is a signal to slow typing speed because when the buffer fills to 190 characters each new keypress will be lost. It is best to never type much faster than your code speed.

Transmitted characters and buffer memory may be monitored using the LCD display on the MFJ-495. This readout is comprised of two lines of text, each containing 16 characters. The top line shows the characters currently being transmitted. The bottom line shows the content of the buffer memory; this buffer line is toggled on and off with the PRINT SCREEN key. Note that non-ASCII characters, such as CTRL, ALT, SHIFT, etc., are displayed as a block character on the buffer line.

If you want to send a special prosign you can enclose it in “<” and “>”. To make a special prosign, begin the prosign with “<”, type the characters of the prosign, and end the prosign with “>”. This will remove the inter-character space between the characters making it a prosign. Any prosign can be made this way, even special local prosigns. Another method is to enclose the prosign with backslashes such as \AA\. An easier way to send special prosign is to press the ALT key, type the characters of the prosign, and then release the ALT key (this method does not work within the terminal program as the ALT key is reserved for other functions).

<p>Note: The open angle bracket “<” enables prosign mode and the close angle bracket “>” disables prosign mode; while the backslash “\” toggles the prosign mode on and off. Also, pressing the ALT key enables prosign mode and releasing disables it. A word space also disables prosign mode.</p>

Keyboard Function Keys

Press a function key F1-F8 to play a saved message of the current memory bank. To record a message, press CTRL+function key; that is, press and hold a CTRL key, press a function key (F1 to F8) and release CTRL. The keyer will respond with "GO" (dah-dah-dit dah-dah-dah). Now a message can be typed into memory. Use the embedded memory commands the same way as on a paddle. To end a message press ENTER.

F9 to F12 is used to quickly select memory bank A to D, respectively.

Keyboard Shortcut Key Combinations

Press a modifier key (CTRL, ALT or SHIFT) in combination with another key to perform special functions or shortcuts. Note that these key combinations do not work with the Keyer Terminal mode, because these modifier keys are reserved for the computer use.

Key	Normal	Shift	Alt	Ctrl
A	a	A	Custom Prosign	
B	b	B	Custom Prosign	Set Bank
C	c	C	Custom Prosign	Set Character Space
D	d	D	Custom Prosign	Decrement
E	e	E	Custom Prosign	Edit Message
F	f	F	Custom Prosign	Set Farnsworth
G	g	G	Custom Prosign	Set Word Space (Gap)
H	h	H	Custom Prosign	Hand Key
I	i	I	Custom Prosign	Set Iambic
J	j	J	Custom Prosign	Set Hang Time
K	k	K	Custom Prosign	Set Key Compensation
L	l	L	Custom Prosign	Set Key Delay (Lag)
M	m	M	Custom Prosign	Set Monitor
N	n	N	Custom Prosign	Set Number
O	o	O	Custom Prosign	Set Output
P	p	P	Custom Prosign	Set Paddle
Q	q	Q	Custom Prosign	Set Queue
R	r	R	Custom Prosign	Set Ratio
S	s	S	Custom Prosign	Set Speed
T	t	T	Custom Prosign	Set Tone
U	u	U	Custom Prosign	Set User
V	v	V	Custom Prosign	Reverse
W	w	W	Custom Prosign	Set Weights
X	x	X	Custom Prosign	Carrier Tune (Xmit)
Y	y	Y	Custom Prosign	Pulse Tune
Z	z	Z	Custom Prosign	Set Zeroes & Nines
F1	Play Message 1		Select User 1	Program Message 1
F2	Play Message 2		Select User 2	Program Message 2
F3	Play Message 3		Select User 3	Program Message 3
F4	Play Message 4		Select User 4	Program Message 4
F5	Play Message 5		Toggle Monitor	Program Message 5
F6	Play Message 6		Toggle Output	Program Message 6
F7	Play Message 7		Toggle Queue	Program Message 7
F8	Play Message 8		Enter Carrier Tune	Program Message 8
F9	Select Bank A		Get Quick Speed 1	Set Quick Speed 1
F10	Select Bank B		Get Quick Speed 2	Set Quick Speed 2

F11	Select Bank C		Get Quick Speed 3	Set Quick Speed 3
F12	Select Bank D		Get Quick Speed 4	Set Quick Speed 4
LEFT	Decrease Setting	Tone -1 Step	Weight -1%	Speed -1 WPM
RIGHT	Increase Setting	Tone +1 Step	Weight +1%	Speed +1 WPM
DOWN	Decrease Setting	Tone -5 Step	Weight -5%	Speed -5 WPM
UP	Increase Setting	Tone +5 Step	Weight +5%	Speed +5 WPM
ESC	Abort/Exit			
BACK SPACE	Delete Character			Delete Word
ENTER	End Message			
PRINT SCREEN	Display Buffer			
PAUSE	Pause			

Using the MFJ-495 with a Terminal Program

The Keyer Terminal mode allows a computer to talk to your MFJ-495. All code sent from the paddle or keyboard is echoed to the Keyer Terminal. All commands are accessible through the Keyer Terminal.

Your computer will need a terminal program to talk to the keyer. The program should be capable of uploading and downloading ASCII text files. Any good commercial or freeware terminal program should be satisfactory for use with this keyer.

After you have connected the MFJ-495 to the serial port of your computer with the correct cable, see the section in this manual on connections, turn on your computer and load your terminal program. Set the baud rate to 1200 and set data bits to 8, parity to none, and stop bits to 1. Also, set flow control to Xon/Xoff. Now turn on your MFJ-495. You should type something on the computer. Whatever you type should appear on the LCD display, which shows that everything is working properly between the computer and keyer. If you do not, recheck your terminal program and serial port cable connection.

You are ready to send with the keyer. To make a special prosign with the keyer terminal, begin the prosign with "<" and end the prosign with ">". For example, to make the prosign AA types <AA>. Another method is to enclose the prosign with backslashes such as \AA\.

Note: The open angle bracket "<" enables prosign mode and the close angle bracket ">" disables prosign mode; while the backslash "\" toggles the prosign mode on and off. A word space also disables prosign mode.

The Memory

Message Memory

To play or save a message memory, select the correct bank by pressing the F4 [BNK] button. To play a message, press and release the corresponding message button (1 - 8). The message will then play (and be sent to your radio). To save a message to memory, press and hold a message

button for two seconds until the keyer plays "GO" (dah-dah-dit dah-dah-dah) in Morse code. You may now key in a message using the paddle, keyboard or terminal.

Paddle

Begin keying your message. As you pause after every word, the keyer will insert a word break. If the keyer does not recognize your code as a valid character, it will display a block character that will not be saved. Continue keying in the rest of the word.

If you make a mistake entering a word, you can back up over it by keying in at least 10 continuous dots. The keyer will erase the previous word. In addition, pressing the Menu button momentarily will delete the last character; pressing and holding the Menu button for two seconds will delete the last word.

At the end of your message, press and hold any of the four message buttons for two seconds to end your message. The keyer will respond by sending an end of message character (di-dah-di-dah-dit) and automatically insert “]” to the end of your message.

Keyboard

You can also store or play messages using the keyboard function keys. To play a message, press any keyboard function key F1-F8. To store a message press and hold the CTRL key, then press a keyboard function key F1-F8, and release CTRL.

Begin typing in your message pressing the space bar between words. The keyer echoes each character as it is typed. Press the BACKSPACE key to delete the last character. In message program mode *only*, press CTRL+BACKSPACE to delete the last word.

At the end of your message, press ENTER. The keyer will play an end of message character (di-dah-di-dah-dit) and save your message.

Keyer Terminal

To play a message in the terminal mode without the keyer menu you type “~##”. The first “#” is message number 1-8, and the second “#” is memory bank A-D. The message is sent to the radio and echoed back to the terminal.

There are two different ways to save a message in the keyer terminal. You can type a message manually or load the message that you have saved in a text file. To save a message, type ~>##MESSAGE TEXT] where ## is the message number and bank followed by the content of the message. The keyer will end the message when the close square bracket “]” is received and it will play an end of message character (di-dah-di-dah-dit).

To view the content of a message, type ~<## where ## is the message number and bank. The memory will echo to the terminal.

Memory

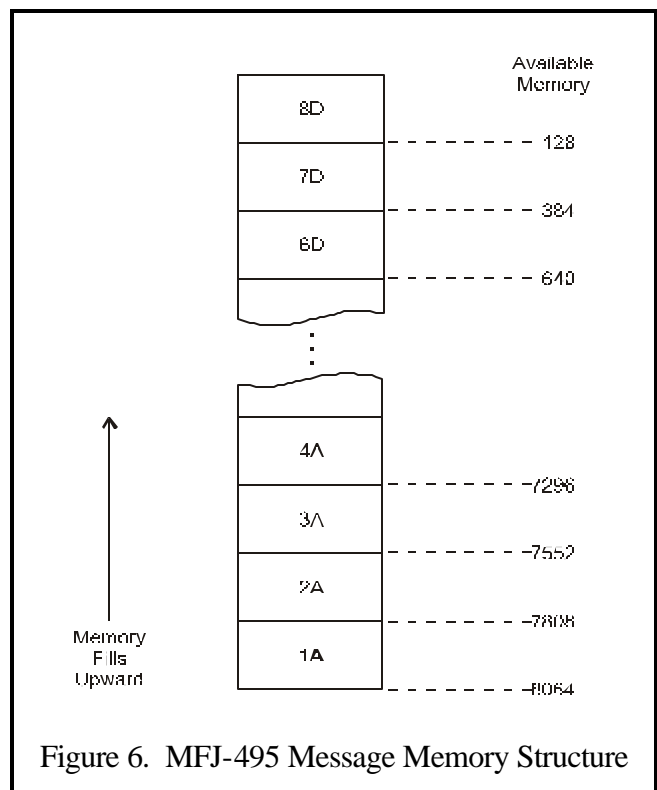
You may compose messages on a computer and load them into the MFJ-495's memory. The unit's memory system is quite flexible and allows up to 32 messages to be saved. One message can call another for additional flexibility. Using the memories, you may prepare the text for a classroom or over-the-air code practice session in advance. Also, a complete set of QSO exchanges can be prepared and loaded into the MFJ-495. The memory is non-volatile, so it is saved even when the power is turned off. Also, it does not require battery backup to preserve the recorded messages.

The unit's 8K memory is organized with four banks of eight blocks that are 256-bytes each, except the last block. This composes of 32 individual memory blocks arranged in a stack structure illustrated in Figure 6. The memory banks are labeled A through D. The total memory available is 7.875K (8064 characters), where 1K = 1024. Each memory block is nominally ¼K (256 characters), except the last block, 8D, that has a capacity of 128 characters. However, an individual message may fill more than one memory block. When this happens, blocks are filled sequentially, moving upward in the diagram. If a message begins in block 1B or higher memory blocks, ¼K is reserved for each of the previous memory blocks.

For example, a message that began in block 3A will, if longer than ¼K characters, flow into block 4A, then into block 5A, and so on. However, it cannot flow downward into block 2A or block 1A. Because each of these lower memory blocks has ¼K reserved, the message starting in block 3A can be a maximum of 7.375K (7552 characters).

The first character displayed on each message menu indicates the status of that memory block. If this character is an open square bracket "[" (the "beginning-of-message" indicator), the displayed block is the beginning of the message, otherwise, it is a portion of the previous memory block. Similarly, if the last character is a close square bracket "]" (the "end-of-message" indicator), the displayed block is the end of the message. Message playback will always start at the beginning of a message no matter which memory block of the message you have selected in the message menu.

For example, if the display shows [1A 2A 3A][4A], there is one continuous message occupying blocks 1A, 2A and 3A and another message in block 4A. In this case, selecting 1A, 2A or 3A for playback will always start the message from block 1A. This message begins in block 1A, flows into block 2A, and ends in block 3A.



Preparing Messages:

To prepare messages, use an ASCII text editor on your computer. Valid characters for messages include all those listed in the chart on page 41, the space, tab and carriage return. In addition, there are special characters, shown in the table below. Any invalid characters in a message will be ignored when the file is downloaded.

Special Characters

Character	Represents
Square Brackets ([])	Delimiters for messages in memory.
Angle Brackets (< >)	Delimiters for custom prosigns.
Back Slashes (\ \)	Delimiters for custom prosigns.
Space+Slash (/)	Prefix for embedded commands.

You may control the unit's features during message playback by using embedded commands. These embedded commands can set sending speed, audio tone, and Farnsworth values. It can also provide great flexibility by allowing functions such as message looping and one message calling another. Embedded commands begin with a slash "/" and must be entered as a separate word. Upper or lowercase letters may be used; embedded commands are not case-sensitive.

When a parameter such as Overall Speed or Tone is specified by an embedded command, the parameter will remain set during the playback of that message. When the playback of that message is completed or stopped, the value of the parameter will revert to the value set prior to the message playback.

Note: ~~Adjusting the Speed control during message playback will undo the setting set by embedded commands /S, /U and /W.~~

Embedded Commands:

While in the message recording mode, you may use embedded commands for special features. To use an embedded command, simply store the multi-character embedded command code within your message. To distinguish embedded commands from normal text, the embedded commands must be entered as a separate word. That means that it must be preceded by a word space (this leading space is ignored during playback). When encountered during message playback, the commands are executed. Note that if "/" is part of a single word, as in K5MFJ/4, it is sent as expected and is not executed as an embedded command. Embedded commands and their uses are explained below:

/## Call – call message ##, where the first # is a single digit in the range of 1 to 8 for the message number and the second # is a letter in the range of A to D for the memory bank. This allows one message to be called from another. When playback of the called message is finished, playback continues with the rest of the calling message. This command has a 16-level deep stack. That means that a message calls another

message, this message then calls another message which in turn calls another message and so on up to 16 times. One message should not call itself or any of its calling messages; otherwise, the stack will overflow resulting in infinite loop.

Note: The message stack size increases to 24 levels deep if the message queue is disabled.

- /D** **D**ecrement – decrements the serial number. Serial number 0001 will decrement to 9999, skipping 0000 since it is not used. This feature allows a serial number to be sent twice in a message. For example: UR RST 559 559 SN /N /D SN /N.
- /F##** **F**arnsworth – sets the current Farnsworth speed to ## WPM, where ## represents two digits in the range of 10 to 99. Setting ## to 00 disables the Farnsworth mode (two zeros must be used here).
- /FU#**
/F+# **F**arnsworth **U**p – increases the Farnsworth speed by # WPM, where # is a single digit in the range of 0 to 9. Increasing (wraparound) to 00 or less than or equal to the overall speed will disable the Farnsworth mode.
- /FD#**
/F-# **F**arnsworth **D**own – decreases the Farnsworth speed by # WPM, where # is a single digit in the range of 0 to 9. Decreasing to 00 or less than or equal to the overall speed will disable the Farnsworth mode.
- /G#** **G**ap – inserts a gap of # standard intra-character spaces into the message, where # is a digit in the range of 1 to 9 (0 can be used but not practical). Invalid numeral code will automatically default to zero. This command is used to exaggerate inter-character and word spacing.
- /J##** **J**ump – go to the message ##, where the first # is a single digit in the range of 1 to 8 for the message number, and the second # is a letter in the range of A to D for the memory bank. This allows you to continue your message into another message. This command can be used to create a loop of multiple messages. Note that any character after “/J##” will not be sent.
- /L** **L**oop – creates a loop of the *current* message. Note that any character after “/L” will not be sent. For example: BEACON AA5CS 5 W /L.
- /N** **N**umber – inserts a contest serial number, in the range of 001 to 9999, into the message. Command Z controls the way zeroes and nines in the serial number are sent. Only three digits are sent for numbers less than 1000--use leading zeros when appropriate. The serial number is automatically post-incremented each time it is sent. The serial number increments from 0001 to 9999 and rolls over to 0001, skipping 0000 since it is not used. The serial number is set to the same one as before when power on. If a different serial number is desired, it must be re-programmed. The serial number can be set from 0000 to 9999 (0000 will automatically convert to 0001). For example: YOU ARE CONTACT NR /N.
- /P##** **P**ause – inserts a timed pause of ## seconds into the message, where ## represents two digits in the range of 00 to 99. When setting pauses under 10 seconds, a leading zero must be used. Pauses greater than 99 seconds are obtained by using consecutive commands that total the desired value. For example: TIMEOUT 1 SEC /P01 TIMEOUT

1 MIN /P60 TIMEOUT 1 MIN 39 SEC /P99 TIMEOUT 2 MIN /P60/P60.

/R Repeat – repeats playback from the beginning, even with calling messages. Note that any character after "/R" will not be sent.

/S## Speed – sets the current overall speed to ## WPM, where ## represents two digits in the range of 05 to 99. When setting speeds under 10 WPM, leading zero must be used.

/SU# Speed Up – increases the overall speed by # WPM, where # is a single digit in the range of 0 to 9.

/SD# Speed Down – decreases the overall speed by # WPM, where # is a single digit in the range of 0 to 9.

/T## Tone – sets the current sidetone frequency to approximately ##0 Hz, where ## represents two digits in the range of 30 to 99. Note that this command sets the sidetone to one of the 24 available frequencies (see table below).

Embedded Tone Command "/T##"

##	Tone Freq.	##	Tone Freq.	##	Tone Freq.
30, 31, 32	305 Hz	54, 55, 56	549 Hz	78, 79, 80	793 Hz
33, 34, 35	335 Hz	57, 58, 59	579 Hz	81, 82, 83	823 Hz
36, 37, 38	366 Hz	60, 61, 62	610 Hz	84, 85, 86	854 Hz
39, 40, 41	396 Hz	63, 64, 65	640 Hz	87, 88, 89	884 Hz
42, 43, 44	427 Hz	66, 67, 68	671 Hz	90, 91, 92	915 Hz
45, 46, 47	457 Hz	69, 70, 71	701 Hz	93, 94, 95	945 Hz
48, 49, 50	488 Hz	72, 73, 74	732 Hz	96, 97, 98	976 Hz
51, 52, 53	518 Hz	75, 76, 77	762 Hz	99	1006 Hz

/TU# Tone Up – increases the sidetone frequency by # available frequency, where # is a single digit in the range of 0 to 9.

/TD# Tone Down – decreases the sidetone frequency by # available frequency, where # is a single digit in the range of 0 to 9.

/U## Ultra Speed – sets the ultra speed mode for a message at speed of ##0 WPM, where ## represents two digits in the range of 10 to 99. For example, “10” is 100 WPM and “99” is 990 WPM. This command is used primarily for meteor scatter work. Note that Farnsworth, Weighting, Character Space, Word Space, Keying Compensation, and Tone settings are disabled during ultra speed message transmission. Also, messages using both regular speed and ultra speed can be created. To exit the ultra speed mode, set ## to 00 such as /U00 and the message will return to regular speed. Alternately, the message can be returned to a lower regular speed by use of the /S, /F, or /W command. ~~Adjusting the Speed control also returns the message to regular speed.~~

/W## Weight – sets the code weight to ## percent, where ## represents two digits in the range of 25 to 75.

/WU# Weight Up – increases the code weight by # percent, where # is a single digit in the

- /W+# range of 0 to 9.
- /WD# **Weight Down** – decreases the code weight by # percent, where # is a single digit in the range of 0 to 9.
- /W-#
- /X## **Xmit** – key the keyer for ## seconds for tuning the transmitter, where ## represents two digits in the range of 01 to 99. Set ## to 00 to key continuously.

Uploading and Downloading Messages:

To send messages either from your computer to the MFJ-495 or from the unit to your computer, use a terminal program on a computer that is capable of transferring ASCII data. Configure the terminal software for 1200 baud, 8 data bits, no parity and one stop bit. To perform the transfer, you prepare either the computer or the Keyer to receive the file, and then send it from the other.

Loading a Memory Block from the Computer

- Type “~>##”, where the first # is a digit in the range of 1 to 8 for the message number and the second # is a letter in the range of A to D for the memory bank. The word "RECEIVING" will appear. The unit now is ready to receive data from your computer.
- Begin sending the data from the computer, and a progress indicator will appear on line two of the display. Invalid data will be ignored during the loading process. To stop loading the data at any time, press Menu.
- The MFJ-495 automatically inserts an open square bracket "[" at the beginning of every message. This is its "beginning-of-message" indicator. When you press Menu to end a transfer, the unit inserts a close square bracket "]" as its "end-of-message" indicator. If you insert a "]" at the end of your message file, the MFJ-495 will stop the transfer automatically when the bracket is received. If the unit runs out of memory, the transfer will be stopped automatically.
- When the message transfer is completed, the unit will display "RECEIVED XXXX", where XXXX is a four-digit number indicating the number of characters received. This number includes the opening and ending message delimiters "[" and "]", plus any tabs and carriage returns.
- Press any button or paddle to return to normal operation.

WARNING: Do not turn the power off while loading the memory; otherwise, the memory can be corrupted.

One way of speeding data transfer is to configure your terminal program to strip out linefeeds that follow carriage returns. While computers store a carriage return as two characters (the carriage return followed by a linefeed), the MFJ-495 stores only the carriage return. It generates the linefeed following it during playback. The additional linefeed thus does not need to be transferred to the Keyer.

Sending Contents of a Memory Block to the Computer

- Configure your terminal program to receive ASCII data.

- Type “~<##”, where the first # is a digit in the range of 1 to 8 for the message number and the second # is a letter in the range of A to D for the memory bank. "SENDING XXXX" will appear on the display, where XXXX is a four-digit number indicating the number of characters in the message plus the message delimiters “[” and “]”.
- A progress indicator will appear on the second line of the display to indicate what percent of the message has been sent.
- To stop the transfer at any time, press Menu or ESC.
- Return to normal operation when the transfer is completed.

The Details

Command [COM] Button

Use to enter the command mode. When a valid command is entered, the keyer will respond with an “R” (di-dah-dit). If an invalid command is entered, it will respond with an error character (di-di-di-di-di-di-dit). See the section titled “The Commands” for more details.

Decrement [DEC] Button

Use to decrement the serial number by one, effectively canceling the automatic increment applied when the message was last played. The decrement function accommodates re-sending the last serial number. This might be needed when a repeat of a contest exchange is requested, or a cancellation of the exchange with a station that proved to be a “dupe”. The unit will echo a "D" (dah-di-dit) for every number that is decremented. Decrementing serial number 0001 rolls over to 9999, because the number 0000 is not used.

Carrier Tune [CXT] Button

Use to engage the carrier tune mode. The keyer will key to tune your station. Press any button, paddle or key to exit. A shortcut from any main menu is to press and hold the Menu button, then press the Dit paddle within two seconds.

Pulse Tune [PXT] Button

Use to engage the pulse tune mode. The keyer will send a continuous string of pulses to tune your station. The pulse rate (or speed) and the duty cycle (or weight) can be adjusted with the function buttons. Press the F1 button to decrease speed and the F2 button to increase speed. Press the F3 button to decrease weight and the F4 button to increase weight. Press the Menu button, the ESC key, or either paddle to exit. A shortcut from any main menu is to press and hold the Menu button, and then to press the Dah paddle within two seconds.

Changing Memory Banks

To change the memory banks, press and hold the Menu button. Then, press the F1 button within two seconds for bank A, the F2 button for bank B, the F3 button for bank C, or the F4 button for bank D.

Command Mode

When a valid command is entered, the keyer will respond with an “R” (di-dah-dit). If an invalid command is entered, it will respond with an error character (di-di-di-di-di-di-di-dit).

Paddle

Press the F1 [COM] button and the keyer responds with “CO” (dah-di-dah-dit dah-dah-dah). A tilde character “~” will appear on the display. A multi-character command can then be entered on your paddle. If the instruction is invalid, the keyer will send an error character (di-di-di-di-di-di-di-dit) and return the keyer to normal mode. If the command is valid, the keyer will send an “R” (di-dah-dit). If you wish to continue modifying features using command mode, you must re-enter the command mode by pressing the F1 [COM] button again. If you enter the command mode accidentally, press F1 [COM] button to exit.

Keyboard

When using the keyboard, press the tilde “~” key to enter command mode. The keyer responds with “CO” (dah-di-dah-dit dah-dah-dah). Type in a command mode command. If the instruction is invalid then the keyer will send an error character (di-di-di-di-di-di-di-dit). At any time, press ENTER to accept or ESC to cancel. Alternately, press CTRL+command key to directly enter the command mode.

Keyer Terminal

Press the tilde key “~” to enter command mode and the keyer responds with “CO” (dah-di-dah-dit dah-dah-dah). Type a command mode command. If the instruction is invalid then the keyer will send an error character (di-di-di-di-di-di-di-dit). Press ENTER to accept or ESC to cancel.

The Commands:

- B#** **Bank** – set the current message memory bank, where # represents A-D.
- C#** **Character spacing** – Where # is an integer 0-9. Use a character break to customize the length of the inter-character spacing. A standard character break is 3 dot lengths long. The number following the C is the number of extra dot lengths added to a standard character break.
- D** **Decrement** – decrements the serial number by one. Decrementing 0001 rolls over to 9999.
- E##** **Edit** – use to edit message ##, where the first # is an integer 1-8 and the second # is a letter A-D. The keyer will display your message to the last word. Then, key in more text or erase existing text, like the procedure of loading a message.
- F##** **Farnsworth** – use to toggle Farnsworth mode on and off and set the current Farnsworth speed to ## WPM, where ## represents two digits in the range of 10 to 99. Setting ## to 00 disables the Farnsworth mode (two zeros must be used here).

Note: It is recommended the Farnsworth mode be disabled when sending with the paddle. When Farnsworth mode is enabled, the keyer will send code at the Farnsworth speed, not the overall speed.

- G#** **Gap** (word spacing) –where #=0-9. Use a word break to customize the length of the inter-word spacing. A standard word break is 7 dot lengths long. The number following the G is the number of extra dot lengths added to a standard word break.
- H** **Hand-key** – enters hand-key mode. Keying output follows closure of the dot or dash paddle or the SPACE key, allowing hand-sent code. Squeezing both paddles or pressing the ESC key regains normal keyer operation.
- Tip:** The space bar on the keyer terminal does not work properly in hand-key mode, because of the typematic delay of the computer keyboard.
- I#** **Iambic** – disables iambic mode with #=N, or sets iambic mode A or B where # represents A or B.
- J####** **PTT hang time** – sets the PTT (push-to-talk) hang time to #### millisecond, where #### represents four digits in the range of 0001 to 9999. This controls the time delay between when CW keying is ended and when the PTT will de-assert.
- K##** **Keying compensation** – sets the keying compensation to ## milliseconds, where ## represents two digits in the range of 00 to 25. Some radios have a key delay of 5 ms or more. By entering K05, the keyer will add 5 ms to the dots and dashes. This eliminates the problems with a transmitter key delay.
- L##** **Lag** (keying delay) – sets the keying delay to ## millisecond, where ## represents two digits in the range of 00 to 20. This setting is used primarily to accommodate switching delay in certain station setups. It is used in conjunction with the PTT line to delay the keying output up to 20 ms during sending. That means that the keying output is lagging behind the sidetone audio and the PTT output. This controls the time delay between when PTT is asserted and when CW keying will start.
- M#** **Monitor** – enables (#=Y) or disables (#=N) the sidetone monitor. Press the ENTER key, or pause the paddle after the M to toggle the sidetone monitor power.
- N####** **Number** – sets the serial number. You must enter four numbers, most significant digit first. All numbers must be in the proper Morse code format. For example, the number "1" must be "di-dah-dah-dah-dah" and the number "0" must be "dah-dah-dah-dah-dah". The serial number can be set from 0000 to 9999 (0000 will be converted to 0001).
- O#** **Output** – enables (#=Y) or disables (#=N) the keying output. Press the ENTER key, or pause the paddle after the O to toggle the keying output power.
- P#** **Paddle** – selects paddle mode of automatic (#=A), semi-automatic (bug, #=S) or hand-key (#=H).
- Q#** **Queue** – enables (#=Y) or disables (#=N) the message queue. Press ENTER key or pause the paddle after the Q to toggle the message queue on or off.
- R##** **Ratio** – sets the speed ratio of the Speed control, where ## represents two digits in the range of 02 to 20. The speed at the full clockwise position of the control is ## times that of the speed at the full counter-clockwise position.
- S##** **Speed** – sets the overall code speed to ## WPM, where ## represents two digits in the range of 05 to 99.

- T## **Tone** – sets the sidetone frequency to approximately ##0 Hz, where ## represents two digits in the range of 30 to 99.
 - T **Tone** – sets the sidetone frequency in the range of approximately 300 to 1000 Hz. Press the dash paddle or “>” key to raise the sidetone frequency; press the dot paddle or “<” key to lower. Squeeze both paddles to exit. Notice an alternating series of dots and dashes are sent to the sidetone monitor to assist in the setting of the desired sidetone frequency.
 - U# **User** – selects the current user, where # represents a digit from 1 to 4. User mode is provided to support four operators with different configuration settings, such as speed, weight, etc.
 - V **reVerse** – reverses the sense of the dot and dash paddles.
 - W#### **Weight** – sets the automatic code weighting between ## percent at the counter-clockwise position and ## percent at the clockwise position of the Speed control, where each ## represents two digits in the range of 25 to 75. Weighting linearly varies with the overall speed (automatic weight). Set both ## to the same value for constant weight, where weighting is independent of the overall speed.
- Tip:** Type W## and then press TAB or ENTER to change only the counter-clockwise position weight. Type W, press TAB, and then type ## to only change the clockwise position weight.
- X **Xmit** (carrier tune) – gives continuous key-down for adjusting a transmitter or antenna tuner. Tap either paddle or any key to exit and release the key line.
 - Y **Pulse tune** – gives continuous adjustable pulses for adjusting transmitter or antenna tuner. Tap either paddle or ESC key to exit and release the key line.
 - Z### **Zeros and nines** – sets the way zeros and nines in the serial number are sent. The first # sets whether to send the leading zeros as "0", "O", "T" or not at all by setting # to "N". The second # sets whether the other zeros are sent as "0", "O" or "T". The last # sets whether the nines are sent as "9" or "N". For example, "ZO09" will send the leading zeros as "O" (dah-dah-dah), the other zeros as "0" (dah-dah-dah-dah-dah), and the nines as "9" (dah-dah-dah-dah-dit).

Command	Via Menu	Via Paddle	Via Keyboard	Via Terminal
Bank	[MENU] + [F1] [MENU] + [F2] [MENU] + [F3] [MENU] + [F4]	[COM] + B#	~B# CTRL+B # F9 F10 F11 F12	~B#
Character Space	Char Space	[COM] + C#	~C# CTRL+C #	~C#
Decrement	[DEC]	[COM] + D	~D CTRL+D	~D
Edit	--	[COM] + E##	~E## CTRL+E ##	~E##
Farnsworth	Farnsworth	[COM] + F##	~F##	~F##

			CTRL+F ##	
Gap (Word Space)	Word Space	[COM] + G#	~G# CTRL+G #	~G#
Hand key	Paddle: Handkey	[COM] + H	~H CTRL+H	~H
Iambic	Iambic	[COM] + I#	~I# CTRL+I #	~I#
PTT Hang Time	PTT Hang Time	[COM] + J#####	~J##### CTRL+J #####	~J#####
Keying Compensation	Key Compensation	[COM] + K##	~K## CTRL+K ##	~K##
Command	Via Menu	Via Paddle	Via Keyboard	Via Terminal
Lag (Keying Delay)	Key Delay	[COM] + L##	~L## CTRL+L ##	~L##
Monitor	Monitor	[COM] + M#	~M# CTRL+M # ALT+F5	~M#
Number	Serial Number	[COM] + N#####	~N##### CTRL+N #####	~N#####
Output	Output	[COM] + O#	~O# CTRL+O # ALT+F6	~O#
Paddle	Paddle	[COM] + P#	~P# CTRL+P #	~P#
Queue	Queue	[COM] + Q#	~Q# CTRL+Q # ALT+F7	~Q#
Ratio	Speed Ratio	[COM] + R##	~R## CTRL+R ##	~R##
Speed	Overall Speed	[COM] + S##	~S## CTRL+S ## CTRL+UP CTRL+DOWN CTRL+LEFT CTRL+RIGHT	~S##
Tone	Tone	[COM] + T##	~T## CTRL+T ## SHIFT+UP SHIFT+DOWN SHIFT+LEFT SHIFT+RIGHT	~T##
User	User	[COM] + U#	~U# CTRL+U # ALT+F1 ALT+F2 ALT+F3 ALT+F4	~U#
reVerse	Reverse	[COM] + V	~V CTRL+V	~V
Weight	CCW Weight CW Weight	[COM] + W#####	~W##### CTRL+W ##### ALT+UP ALT+DOWN ALT+LEFT ALT+RIGHT	~W#####

Xmit (carrier tune)	[CXT] [MENU] + Dah	[COM] + X	~X CTRL+X ALT+F8	~X
pulse tune	[PXT] [MENU] + Dit	[COM] + Y	~Y CTRL+Y	~Y
Zeroes and nines	Leading Zeroes Other Zeroes Nines	[COM] + Z###	~Z### CTRL+Z ###	~Z###

Note: Terminal commands can be used via the keyboard, but not vice versa.

Table 4. Command Mode Commands.

Bank (B#)

Use to select the current memory bank.

Paddle

To set the current memory bank, press [COM] then key a “B” followed by “A”, “B”, “C” or “D” for the selected memory bank.

Keyboard

Type “~B#” to set the current memory bank, where # represents A to D. Press F9-F12 to reference banks A-D, respectively.

Keyer Terminal

Type “~B#” to set the current memory bank, where # represents A to D.

Character Space (C#)

Character space is normally three units in length. Use this mode to increase character spacing up to 12 units. Note that the character space is always at least four units shorter than the word space.

Paddle

To change the character spacing, press [COM] then key a “C” followed by a number 0-9, to add to the standard character space.

Keyboard

To enter Character Space, type “~C”. Press either the LEFT or RIGHT button to increase or decrease character spacing. Or, you may press a number 0 to 9 to add to the standard character space. Press ENTER to accept and exit, or press ESC to cancel and exit.

Keyer Terminal

To use Character Space, type “~C”. Press the < and > keys to change character space or type in a number 0 to 9 to add to the standard character space. Press ENTER to accept and exit, or press ESC to cancel and exit.

Decrement (D)

Use to decrement the serial number by one, effectively canceling the automatic increment applied when the message was last played. The decrement function accommodates re-sending the last serial number. This might be needed when a repeat of a contest exchange is requested, or canceling the exchange with a station that proved to be a "dupe". The unit will echo a "D" (dah-di-dit) for every number that is decrement. Decrement serial number 0001 rolls over to 9999, because the number 0000 is not used.

Paddle

To decrement the serial number, press [COM], then key a "D". Alternately, pressing [DEC] also decrements the serial number.

Keyboard

To decrement the serial number, type "~D".

Keyer Terminal

To decrement the serial number, type "~D".

Edit Message (E##)

Use Edit message to change a message memory. It allows you to add to or edit an existing message by entering the "E" command in function mode, followed by the number (1-8) and bank (A-D) of the message. The keyer will begin playing the message.

Paddle

From the command mode, key "E##" (# = 1-8, # = A-D). The keyer will display your message. Then, key in more text or erase existing text, like the procedure of loading a message.

Keyboard

Type in "~E##" (# = 1-8, # = A-D). The keyer will display your message. Then, key in more text or erase existing text, like the procedure of loading a message.

Keyer Terminal

Type in "~E##" (# = 1-8, # = A-D). The keyer will display your message to the last word. Then, key in more text or erase existing text, like the procedure of loading a message.

Farnsworth Speed (F##)

Use Farnsworth Speed mode to change the character spacing of the code. An alternating dot/dash is produced and the speed is modified by using the paddles, keyboard or keyer terminal.

Farnsworth spacing adds more time between characters to slow down the overall sending speed. The advantage of this is that, by hearing the characters sent at a faster speed, you learn to recognize each character by its distinctive rhythm, rather than by trying to "count dits." This greatly assists you in copying Morse code at higher speeds.

However, the Farnsworth speed must be higher than the overall speed. To turn Farnsworth off, reduce the Farnsworth speed to the same speed as the overall speed.

Paddle

Press either the dot or dash paddle to increase or decrease speed. Squeeze the paddles simultaneously to exit.

Note: It is recommended the Farnsworth mode be disabled when sending with the paddle. When Farnsworth mode is enabled, the keyer will send code at the Farnsworth speed, not the overall speed.

Keyboard

To enter Farnsworth Speed mode, type “~F”. Either press the LEFT or RIGHT button to increase or decrease speed. Or press two numbers 10-99 to set the speed. Press ENTER to accept and exit or ESC to cancel and exit.

Keyer Terminal

To use Farnsworth Speed mode, type “~F”. Press the < and > keys to change speed, or type two numeric characters 10-99 to set speed. Press ENTER to accept and exit or ESC to cancel and exit.

Gap (Word Space) (G#)

Word space is normally seven units in length. Use this mode to increase word spacing up to 16 units. Note that the word space is always at least four units longer than the character space.

Paddle

To change the word spacing, press [COM] then key a “G” followed by a number 0-9 to add to the standard word space.

Keyboard

To enter Word Space mode, type “~G”. Either press the LEFT or RIGHT button to increase or decrease word spacing. Or, press a number 0-9 to add to the standard the word space. Press ENTER to accept and exit or ESC to cancel and exit.

Keyer Terminal

To enter Word Space mode, type “~G”. Press the < and > keys to change word space or type a number 0-9 to add to the standard word space. Press ENTER to accept and exit or ESC to cancel and exit.

Hand Key (H)

Enter Hand Key mode to use your paddle or space bar as a hand (straight) key. The keyer responds with "HK" (di-di-di-dit dah-di-dah). Dots and dashes are made manually by using either paddle or the space bar on your keyboard. Squeeze paddles simultaneously or press ESC to exit.

Paddle

Dots and dashes are made manually by using either paddle. Squeeze both paddles to exit.

Keyboard

To enter Hand key mode type “~H”. Dots and dashes are made manually by using the space bar on your keyboard. Press ESC to exit.

Keyer Terminal

The space bar on the keyer terminal does not work properly in this mode, because of the typematic delay of the computer keyboard. Press ESC to exit.

Iambic (I#)

Use the Iambic command to disable iambic operation or to enable iambic mode A or B. The keyer responds with the current mode “OFF” (dah-dah-dah di-di-dah-dit di-di-dah-dit), “A” (di-dah) or “B” (dah-di-di-dit). Iambic mode allows you to squeeze both paddles and get alternating dots and dashes. The iambic modes work when you squeeze both paddles together. In iambic B mode the keyer plays the alternating element after the paddles are released during an element. Iambic A mode does not produce an alternating element when the paddles are released during an element. For example, a release during the dash produces "dit-dah" (A) in iambic A mode but produces "dit-dah-dit" (R) in iambic B mode. Non-iambic mode does not alternate between dots and dashes during a squeeze. It plays whatever side made contact first until it is released.

Paddle

To change Iambic mode, press [COM] then key an “I” followed by an “A” for iambic A mode, a “B” for iambic B mode, or an “N” to disable iambic mode.

Keyboard

To enter Iambic mode type “~I”. Then type an A to set iambic A mode and the keyer responds with an "A". Type B to set iambic B mode and the keyer responds with a "B". Or, type an N to turn iambic mode off and the keyer responds with "OFF". Press ESC to cancel and exit.

Keyer Terminal

To enter Iambic mode type “~I”. Then type A to set iambic A mode and the keyer responds with "A". Type B to set iambic B mode and the keyer responds with "B". Or type N to turn iambic mode off and the keyer responds with "OFF". Press ESC to cancel and exit.

PTT Hang Time (J####)

Use PTT Hang Time to set the hang time of the PTT output. This hang time set the amount of time delay between when CW keying is ended and when the PTT line will de-assert. You may adjust this to your liking for on-the-air sending.

Paddle

To change the PTT hang time, press [COM], then, key a “J” followed by a four-digit number representing 0001 to 9999 milliseconds.

Keyboard

To enter PTT Hang Time, type “~J”. ~~Press either the LEFT or RIGHT to increase or decrease the hang time.~~ Or, press four numbers 0001 to 9999 to set the hang time. Press ENTER to accept and exit or ESC to cancel and exit.

Keyer Terminal

To enter PTT Hang Time, type “~J”. ~~Press the < and > keys to change the hang time or~~ type four numeric characters 0001 to 9999 to set the hang time. Press ENTER to accept and exit or ESC to cancel and exit.

Keying Compensation (K##)

Use Keying Compensation to increase keying on-time and decrease keying off-time in ## milliseconds. Although similar to increasing weight, the adjustment is independent of speed. This setting is used primarily to correct keying distortion of certain transceivers.

Paddle

To change the keying compensation, press [COM] then key a “K” followed by a two-digit number 00 to 25.

Keyboard

To enter Keying Compensation, type “~K”. Either press the LEFT or RIGHT button to increase or decrease compensation. Or, press two numbers 00-25 to set the compensation time. Press ENTER to accept and exit, or press ESC to cancel and exit.

Keyer Terminal

To enter Keying Compensation, type “~K”. Press the < and > keys to change compensation or type in two numeric characters 00-25 to set compensation time. Press ENTER to accept and exit or ESC to cancel and exit.

Lag (Keying Delay) (L##)

Use Keying Delay to delay keying output by ## milliseconds. This setting is used primarily to accommodate switching delay in certain station setups.

Paddle

To change keying delay, press [COM] then key an “L” followed by a two-digit number 00-20.

Keyboard

To enter Keying Delay, type “~L”. Either press the LEFT or RIGHT button to increase or decrease delay. Or, press two numbers 00-20 to set the delay time. Press ENTER to accept and exit or ESC to cancel and exit.

Keyer Terminal

To enter Keying Delay, type “~L”. Press the < and > keys to change delay time or type two numeric characters 00-20 to set the delay time. Press ENTER to accept and exit or ESC to cancel and exit.

Monitor (M#)

Use Monitor On/Off to toggle sidetone speaker power. The keyer responds with the current mode "ON" or "OFF". If the sidetone is turned off, it will still play command messages and status information. To conserve battery power, the keyer should be operated with the monitor off in favor of the rig's sidetone. You can also use the keyboard to toggle monitor on/off by pressing CTRL+F5.

Paddle

To change Monitor mode, press [COM], then, key an "M" followed by a "Y" for on, an "N" for off, or pause to toggle.

Keyboard

To change Monitor mode, type "~M", followed by a "Y" for on, an "N" for off, or ENTER to toggle. Press ESC or any other key to cancel and exit. You may also press ALT+F5 to toggle monitor on/off.

Keyer Terminal

To change Monitor mode, type "~M" followed by a "Y" for on, an "N" for off, or ENTER to toggle. Press ESC or any other key to cancel and exit.

Number (N####)

Use Number to set the current serial number to ####. Note that in a transmission of a serial number, only three digits are sent for serial numbers below 1000.

Paddle

You must enter four numbers in Morse code for a valid serial number. All numbers may not be in shorthand. For example, the number "1" must be "dit-dah-dah-dah-dah" and the number "0" must be "dah-dah-dah-dah-dah". The serial number can be set from 0000 to 9999 (0000 will automatically convert to 0001).

Keyboard

To enter Serial Number, type "~N". Then, type up to four numbers to set the current serial number. Press ENTER to accept and exit or ESC to cancel and exit.

Keyer Terminal

To enter Serial Number, type "~N". Then, type up to four numbers to set the current serial number. Press ENTER to accept and exit or ESC to cancel and exit.

Output (O#)

Use Output On/Off to toggle output power. The keyer responds with the current mode "ON" or "OFF". If the output is turned off, no signal goes to the Keying Output or the PTT Output to allow practice operation. The output is temporarily disabled during memory message storing, command mode operation, status information, and keyer setup. You can also use the keyboard to toggle output on/off by pressing CTRL+F6.

Paddle

To change Output mode, press [COM], then, key an “O” followed by a “Y” for on, an “N” for off, or pause to toggle.

Keyboard

To change Output mode, type “~O” followed by a “Y” for on, an “N” for off, or ENTER to toggle. Press ESC or any other key to cancel and exit. You may also press ALT+F6 to toggle output on/off.

Keyer Terminal

To change Output mode, type “~O” followed by a “Y” for on, an “N” for off, or ENTER to toggle. Press ESC or any other key to cancel and exit.

Paddle (P#)

Use Paddle to set automatic, semi-auto (bug), or hand-key mode. Semi-auto mode creates automatic dots but requires dashes to be hand keyed. Notice hand-key mode may not be used to enter messages, serial numbers or commands in command mode.

With the automatic option, the keyer functions as an iambic keyer for use with a dual-lever paddle. The MFJ-495 has dot and dash memories, for "squeeze keying," and functions just like other iambic keyers, such as standalone keyers and those built into radios. With semi-auto, the keyer can be used with a single-lever key. Dots are generated automatically and dashes are formed manually by the user. This emulates the function of a mechanical semi-automatic "bug." You also may use this unit with a straight key or a bug. Just connect the straight key or bug to the ground and the dash line, or with the hand-key option, both the dot and dash lines can be used to connect to a straight key.

Note: In hand-key mode, the MFJ-495 will neither display the code sent nor record to the keyer memory.

Paddle

To set the paddle mode, press [COM], then, key a “P” followed by an “A” for automatic, an “S” for semi-automatic, or an “H” for hand-key.

Keyboard

To enter Paddle, type “~P”. Then, type an A to set automatic, an S to set semi-automatic, or an H to set hand-key mode. Press ESC to cancel and exit.

Keyer Terminal

To enter Paddle, type “~P”. Then, type an A to set automatic, an S to set semi-automatic, or an H to set hand-key mode. Press ESC to cancel and exit.

Queue (Q#)

Use Queue On/Off to toggle queue mode on and off. The keyer responds with the current mode "ON" or "OFF". Queue mode enables the user to load messages into a buffer to play sequentially. In queue mode, if you press a memory button while a message is playing, that message will play after the current message is done. When queue mode is off, pressing a

message memory will abort any message being played and play the new message. When on, up to 16 button presses are stored in order, and acted upon in succession as each message is completed. You can also use the keyboard to toggle queue on/off by pressing ALT+F7.

Note: Disabling the queue mode increases the message stack size to 24 levels deep (used by the embedded Call command).

Paddle

To change Queue mode, press [COM], then, key a "Q" followed by a "Y" for on, an "N" for off, or pause to toggle.

Keyboard

To change Queue mode, type "~Q", followed by a "Y" for on, an "N" for off, or ENTER to toggle. Press ESC or any other key to cancel and exit. You may also press ALT+F7 to toggle queue on/off.

Keyer Terminal

To change Queue mode, type "~Q" followed by a "Y" for on, an "N" for off, or ENTER to toggle. Press ESC or any other key to cancel and exit.

Speed Ratio (R##)

Use Speed Ratio to set the range ratio of the front-panel Speed control.

Paddle

To change the speed ratio, press [COM] then key an "R" followed by a two-digit number 02-20.

Keyboard

To enter Speed Ratio, type "~R". Either press the LEFT or RIGHT button to increase or decrease ratio, or press two numbers 02-20 to set the speed ratio. Press ENTER to accept and exit or ESC to cancel and exit.

Keyer Terminal

To enter Speed Ratio, type "~R". Press the < and > keys to change the ratio or type in two numeric characters 02-20 to set the speed ratio. Press ENTER to accept and exit, or press ESC to cancel and exit.

Overall Speed (S##)

This menu allows you to select a keying speed from 5 to 99 words per minute (wpm). An alternating dot/dash is produced and using the paddles, keyboard or keyer terminal you can modify the speed. By "overall" speed, we mean the speed at which the words or groups are sent. A "word" is defined as 50 units of time, and the word "PARIS" is exactly 50 units in length. Therefore, if "PARIS" is sent 13 times in one minute, the sending speed is 13 wpm.

Standard Morse code timing defines a dit as one unit of time and a dah as three units of time. Within each character, there is one unit between elements (dits and dahs). Three units separate characters, and seven units separate words. Farnsworth spacing will increase the amount of time between characters and words. Note that setting the overall speed greater than or equal to the Farnsworth speed will disable Farnsworth spacing.

Paddle

Press either the dot or dash paddle to increase or decrease speed. Squeeze paddles to exit.
???? two-digit number

Keyboard

To enter Overall Speed mode, type “~S” or CTRL+S. Either press the LEFT or RIGHT button to decrease or increase speed. Or press two numbers 05 to 99 to set the code speed. Press ENTER to accept and exit, or press ESC to accept and exit.

Keyer Terminal

To set overall speed, type “~S”. Press the < and > keys to change speed or type in two numeric characters 05-99 to set speed. Press ENTER to accept and exit or ESC to cancel and exit.

Tone (T##)

The Tone menu allows you to select the audio frequency sent by the unit. You may select a frequency that pleases you ranging from 305 to 1006 Hz. The MFJ-495 features smooth, clean audio, with sine wave output, instead of the harsh square wave audio used by many other keyers. Also, the MFJ-495 produces each dit and dah with a rise and decay time of approximately 5 milliseconds, avoiding the "spikes" that cause distracting key clicks. The MFJ-495's audio sounds like that of a good CW transceiver.

Paddle

Press either the dot or dash paddle to decrease or increase sidetone. Squeeze paddles to exit.

Keyboard

To enter Tone set, press “~T” or CTRL+T. Either press the LEFT or RIGHT button to decrease or increase tone frequency. Press ENTER to accept and exit or ESC to cancel and exit. You may also type two digits 30-99 to set the tone frequency.

Keyer Terminal

To set sidetone, type “~T”. Then, use the < and > keys to change sidetone. Press ENTER to accept and exit or ESC to cancel and exit. You may also type two digits 30-99 to set the tone frequency.

User (U#)

The User menu allows four operators with different configuration settings, such as speed, weight, etc., to use the keyer without having to reconfigure all the settings for each operator. It also supports four different configuration settings for different contest exchanges.

Paddle

To change User mode, press [COM], then, key a “U” followed by a “1” for user 1, a “2” for user 2, a “3” for user 3, or a “4” for user 4.

Keyboard

To change User mode, type “~U”, followed by a number 1-4 to select one of the four users. Press ESC or any other key to cancel and exit. You may also press ALT+F1 to select user 1, ALT+F2 for user 2, ALT+F3 for user 3, or ALT+F4 for user 4.

Keyer Terminal

To change User mode, type “~U” followed by a number 1-4 to select one of the four users. Press ESC or any other key to cancel and exit.

Reverse (V)

Use Reverse to change the dot and dash paddles assignment. The keyer responds with "RV" (di-dah-dit di-di-di-dah) and changes the dot paddle to dash and the dash paddle to dot.

When using paddles, the MFJ-495 normally expects the dot paddle to be connected to the tip of the plug and the dash paddle to be connected to the plug's ring. If your paddles are wired in the opposite manner, or you wish to change between right- and left-handed operators, you may turn Reverse ON to switch the paddle functions. You can also set this mode by simply pressing the paddle you desire to designate as the dot paddle within the Reverse setup menu.

Paddle

To reverse the paddles, press [COM], then, key a “V”.

Keyboard

To reverse the paddles, type “~V”.

Keyer Terminal

To reverse the paddles, type “~V”.

Weight (W#####)

Use Weight to modify the weight settings for code. An alternating dot/dash is produced and the paddle, keyboard or keyer terminal is used to change weight.

Weight is the duty cycle of a continuous string of dots, where 50% is perfect code. A higher weight produces a heavier sound and a lower weight causes characters to sound lighter. Weight can be set to remain constant and independent of speed, or it can be set to vary with the code speed.

Paddle

Press either dot or dash paddle to decrease or increase weight. Squeeze paddles to exit.

Keyboard

Type “~W” or CTRL+W. Either press the LEFT or RIGHT button to change *constant* weight. Press ENTER to accept and exit or ESC to cancel and exit. You may also type two pairs of two digits 25-75 to set automatic *linear* weight.

Keyer Terminal

To set code weight, type “~W”. Then, use the “<” and “>” keys to change *constant* weight. Press ENTER to accept and exit or ESC to cancel and exit. You may also type two pairs of two digits 25-75 to set automatic *linear* weight.

Tip: Type “W##” and then press TAB or ENTER to change only the counter-clockwise position weight. To change only the clockwise position weight, type W, press TAB, and then type ##.

Xmit (Carrier Tune) (X)

Use Carrier Tune (Xmit) to tune up your station. A constant key is sent to allow tuning of your tuner or antenna. Simply tapping either the dot or dash paddle lever or pressing any key stops tuning.

Paddle

Press [COM] then, key an “X” to enable the output to tune continuously. Tap either paddle to exit.

Keyboard

Type “~X” or ALT+F8 to enable the output to tune continuously. Press any key to exit.

Keyer Terminal

Type “~X” to enable the output tune continuously. Press any key to exit.

Pulse Tune (Y)

Use Pulse Tune to tune up your station. Continuous adjustable pulses are sent to allow tuning of your tuner or antenna. Simply tapping either the dot or dash paddle lever or pressing the Menu button or the ESC key stops tuning. You change the speed by pressing the F1 and F2 buttons and the weight of pulses by pressing the F3 and F4 buttons.

Paddle

Press [COM], then, key a “Y” to enable the pulse tune mode. Tap either paddle to exit.

Keyboard

Type “~Y” enables the pulse tune mode. Press ESC key to exit. Use CTRL+arrow keys to change the speed and ALT+arrow keys to change the weight of the pulses.

Keyer Terminal

Type “~Y” to enable the pulse tune mode. Press ESC key to exit.

Zeroes and Nines (Z####)

Use to set the way zeros and nines in the serial number are sent. The first # sets whether to send the leading zeros as "0", "O", "T" or not at all by setting # to "N". The second # sets whether the other zeros are sent as "0", "O" or "T". The last # sets whether the nines are sent as "9" or "N". For example, "ZO09" will send the leading zeros as "O" (dah-dah-dah), the other zeros as "0" (dah-dah-dah-dah-dah), and the nines as "9" (dah-dah-dah-dah-dit).

Paddle

Press [COM], then, key "Z###" to set zeros and nines formats.

Keyboard

Type "~Z###" to set zeros and nines formats.

Keyer Terminal

Type "~Z###" to set zeros and nines formats.

Appendices

Resetting the Keyer

Each time the keyer is turned off, the microprocessor powers down and saves all memories and configurations to non-volatile memory. This memory will be ready to use the next time the unit is turned on. If the keyer is not working properly, try resetting to the factory defaults.

Factory Defaults

The unit is shipped with the following default settings for all users 1 to 4:

- Main Menu [1A][2A][3A][4A]
- Setup Menu Speed Ratio
- Memory Bank A
- Speed Control Range 13 to 39 WPM
- Speed Ratio 3-to-1
- Overall Speed 13 WPM
- Farnsworth off
- Weight 50% constant
- Character Space 3 units
- Word Space 7 units
- Keying Compensation 0 msec
- Keying Delay 0 msec
- PTT Hang Time 1000 msec
- Tone Frequency 701 Hz
- Serial Number 0001
- Leading Zeroes on and send as O (dah-dah-dah)
- Other Zeroes send as 0 (dah-dah-dah-dah-dah)
- Nines send as 9 (dah-dah-dah-dah-dit)
- Iambic Mode A
- Reverse Mode off (dot to tip, dash to ring)
- Paddle Mode automatic
- Monitor Mode on
- Output Mode on
- Queue Mode on
- Enter Key end message
- Pulse Tune Speed 75 WPM
- Pulse Tune Weight 13%
- Quick Speeds 13, 15, 18 and 20 WPM

To reset the keyer to these defaults:

1. Skip to step 6 if you want to reset the current user; otherwise, continue with step 2.
2. Turn on the power to the keyer.
3. Press and hold the Menu button for two seconds to go to the setup menus.
4. Press the Previous or Next button to go to the User menu.

5. Press the Up or Down button to select the user to be reset to factory defaults.
6. Turn off the power to the keyer.
7. Press and hold *both* the Menu and F2 buttons while turning the power on.
8. Release the buttons when "DEFAULTS RESET" appears on the display.
9. Resume with normal operation.

Note: If the MFJ-495 is not working properly, try resetting the keyer to factory defaults.

Message Memory Reset

To erase all message memories, hold down the Menu and F4 buttons while turning the power on. A confirmation message "ERASE ALL MSGS?" will display. Press F1 [YES] button to clear all message memories, or press F4 [NO] button to cancel. Release the button to resume normal operation. Remember, if you press F1 [YES], all stored messages will be lost.

To erase a message, select that message for recording. Without typing or keying anything into memory, end the recording by typing "]" or holding down any function button for two seconds.

Self Test

A self-test routine will check the functions of the MFJ-495. This routine checks the display, the paddles, the front-panel buttons, the remote port, the internal memory and the audio circuitry. During the self-test, you may stop the test by turning off the unit; however, this should NOT be done during the memory test or the memory could be corrupted. The self-test can be completed in approximately 30 seconds.

Connections of the serial port and keyboard are not necessary for this test.

Note: Performing the self-test will reset the unit to its factory default settings for all four users and select user 1 as the current user.

Here is the self-test procedure:

1. Turn off the power to the keyer.
2. Connect a paddle to the Key Input jack. Connect a remote control to the Remote port if you have one.
3. Turn Speed control to full clockwise position. Set volume to a comfortable listening level.
4. Press and hold *only* the Menu button while turning the power on.
5. The test begins by displaying a copyright message and firmware version number. This is the test of the display. This message is also sent to the serial port. Release the Menu button before the message completes.
6. You will be prompted to press the dot and dash paddles. This assumes the dot paddle is connected to the tip of the plug and the dash paddle to the ring of the plug. The LED should blink once for each press.
7. You will be prompted to press each of the front-panel buttons. The LED should blink once for each press.

8. You will be prompted to press the dot and dash connections of the Remote port. If you do not have a remote control, you can use the paddle. The LED should blink once for each press.
9. You will be prompted to press the function button connections of the Remote port. If you do not have a remote control, you can press the front-panel buttons. The LED should blink once for each press.
10. Test the Speed control by turning it to full counter-clockwise then to full clockwise. The LED should blink once at the end of each turn.
11. The unit then tests its non-volatile memory. Notice this step will reset the unit to its factory default for all four users, and select user 1 as the current user.
12. If the unit is okay, a repetitive message "PASS" will be displayed and sent as audio. If there is a problem, a failure message will be displayed and sent.
13. Once you have confirmed that the audio is okay, turn the unit off.

Failure Message Meanings:

- DASH FAIL Dash paddle (ring of the plug) is shorted or improperly connected.
- DOT FAIL Dot paddle (tip of the plug) is shorted or improperly connected.
- F1 FAIL F1 button is shorted or improperly connected.
- F2 FAIL F2 button is shorted or improperly connected.
- F3 FAIL F3 button is shorted or improperly connected.
- F4 FAIL F4 button is shorted or improperly connected.
- MEMORY FAIL Non-volatile memory circuitry is improperly connected.
- MENU FAIL Menu button is shorted or improperly connected.
- PD FAIL Power down circuitry is bad.
- SPEED FAIL Speed control is bad.

Power Down Circuit Test

This test checks the power down circuitry. It is recommended that this test be done immediately after the regular self-test described above.

Note: The keyer must be reset to factory defaults before performing this test.

Here is the test procedure:

1. Make sure power to the keyer is off.
2. If the keyer has been reset to factory defaults, skip to step 7; otherwise continue with step 3.
3. Press and hold *both* the Menu and F2 buttons while turning the power on.
4. Release both buttons when "DEFAULTS RESET" appears on the display.
5. Make sure the display shows "[1A][2A][3A][4A]"; however, depending on your message memory, some brackets "[" and "]" might not show on your display.
6. Turn the power off.
7. Press and hold *only* the F2 button while turning the power on.
8. If the power down circuitry is okay, a repetitive message "PASS" will be displayed and sent as audio. If there is a problem, message "PD FAIL" will be displayed and sent as audio repetitively.

9. Turn the power off.

Troubleshooting

Problem: Farnsworth mode will not enable.

Solution: The overall speed is at its maximum of 99 WPM.

Problem: Speed control does not seem to change code speed

Solution: The Farnsworth mode is enabled with speed greater than the maximum speed of the Speed control.

Problem: Extra linefeeds appear when uploading the computer.

Solution: Configure your terminal program to strip the linefeeds from the carriage returns.

Problem: Keyer is not acting properly.

Solution: Reset the keyer to factory defaults setting by pressing both Menu and F2 buttons while turning the power on.

Problem: Character spacing will not increase.

Solution: The word spacing must be at least four units more than the character spacing.

Problem: The keyer keys continuously when the power is turned on.

Solution: Make sure the Manual Key jumper JMP3 is set to the correct logic.

Technical Assistance

If you have any problem with this unit first check the appropriate section of this manual. If the manual does not reference your problem or your problem is not solved by reading the manual you may call *MFJ Technical Service* at **662-323-0549** or the *MFJ Factory* at **662-323-5869**. You will be best helped if you have your unit, manual and all information on your station handy so you can answer any questions the technicians may ask.

You can also send questions by mail to MFJ Enterprises, Inc., 300 Industrial Park Road, Starkville, MS 39759; by FAX to 662-323-6551; or by email to techinfo@mfjenterprises.com. Please include a complete description of the problem, an explanation of exactly how you are using the unit when the problem arises, and a complete description of any equipment you are using with this unit, such as a computer (including applicable software) or radio.

Morse Code Character Set¹

A	di-dah	•—	N	dah-dit	—•
B	dah-di-di-dit	—•••	O	dah-dah-dah	— — —
C	dah-di-dah-dit	—•—•	P	di-dah-dah-dit	•— —•
D	dah-di-dit	—••	Q	dah-dah-di-dah	— —•—
E	dit	•	R	di-dah-dit	•—•
F	di-di-dah-dit	••—•	S	di-di-dit	•••
G	dah-dah-dit	— —•	T	dah	—
H	di-di-di-dit	••••	U	di-di-dah	••—
I	di-dit	••	V	di-di-di-dah	•••—
J	di-dah-dah-dah	•— — —	W	di-dah-dah	•— —
K	dah-di-dah	—•—	X	dah-di-di-dah	—••—
L	di-dah-di-dit	•—••	Y	dah-di-dah-dah	—•— —
M	dah-dah	— —	Z	dah-dah-di-dit	— —••
1	di-dah-dah-dah-dah	•— — — —	6	dah-di-di-di-dit	—••••
2	di-di-dah-dah-dah	••— — —	7	dah-dah-di-di-dit	— —•••
3	di-di-di-dah-dah	•••— —	8	dah-dah-dah-di-dit	— — —••
4	di-di-di-di-dah	••••—	9	dah-dah-dah-dah-dit	— — — —•
5	di-di-di-di-dit	•••••	0	dah-dah-dah-dah-dah	— — — — —
Period	[.]	di-dah-di-dah-di-dah	•—•—•—	AAA	
Comma	[,]	dah-dah-di-di-dah-dah	— —••— —	MIM	
Question Mark or Request for Repetition	[?]	di-di-dah-dah-di-dit	••— —••	IMI	
Fraction Bar	[/]	dah-di-di-dah-dit	—••—•	DN	
End of Message or Cross	[+]	di-dah-di-dah-dit	•—•—•	AR	
End of Work	[*]	di-di-di-dah-di-dah	•••—•—	SK	
Double Dash, Pause or Break	[=]	dah-di-di-di-dah	—•••—	BT	
Semicolon	[;]	dah-di-dah-di-dah-dit	—•—•—•	KR	
Colon	[:]	dah-dah-dah-di-di-dit	— — —•••	OS	
Apostrophe	[']	di-dah-dah-dah-dah-dit	•— — — —•	WG	
Quotation Mark	["]	di-dah-di-di-dah-dit	•—••—•	AF	
Hyphen or Dash	[-]	dah-di-di-di-di-dah	—••••—	DU	
Underline	[_]	di-di-dah-dah-di-dah	••— —•—	IQ	
Dollar Sign	[\$]	di-di-di-dah-di-di-dah	•••—••—	SX	
Left Parenthesis	[(]	dah-di-dah-dah-dit	—•— —•	KN	
Right Parenthesis	[)]	dah-di-dah-dah-di-dah	—•— —•—	KK	
Wait	[&]	di-dah-di-di-dit	•—•••	AS	
Understood	[!]	di-di-di-dah-dit	•••—•	SN	
Starting Signal	[%]	dah-di-dah-di-dah	—•—•—	KA	
Error	[@]	di-di-di-di-di-di-di-dit	••••••••	HH	
Paragraph	[#]	di-dah-di-dah-di-dit	•—•—••	AL	
Invitation to Transmit		dah-di-dah	—•—	K	

1. FCC test requirement consists the 26 letters, the 10 numerals, the period, the comma, the question mark, \overline{AR} , \overline{SK} , \overline{BT} and \overline{DN} .

Signals Used in Other Radio Services

Interrogatory	di-di-dah-di-dah	•• - • -	\overline{INT}
Emergency Silence	di-di-di-di-dah-dah	•••• - -	\overline{HM}
Executive Follows	di-di-dah-di-di-dah	•• - •• -	\overline{IX}
Break-in Signal	dah-dah-dah-dah-dah	- - - - -	\overline{TTTTT}
Emergency Signal	di-di-di-dah-dah-dah-di-di-dit	••• - - - •••	\overline{SOS}
Relay of Distress	dah-di-di-dah-di-di-dah-di-dit	- •• - •• - ••	\overline{DDD}

Some CW Abbreviations

73	Best regards	NR	Number; near
88	Love and kisses	NW	Now
ABT	About	OM	Old man
AGN	Again	OP	Operator
ANT	Antenna	R	Are; received; roger
BK	Back; break	RCVR	Receiver
CPY	Copy	RIG	Station equipment
CQ	Calling any station	RITE	Right
CUL	See you later	RST	Readability, strength, tone report
CU	See you	SIGS	Signals
DE	From	SKED	Schedule
DEG	Degree	STN	Station
DX	Distance; rare station	TEMP	Temperature
ES	And; "&"	TKS	Thanks
FB	Fine business; excellent	TNK	Thank
FER	For	TNX	Thanks
FREQ	Frequency	UR	Your; you're; you are
GA	Good afternoon	U	You
GE	Good evening	WL	Well; will
GM	Good morning	WTS	Watts
GN	Good night	WX	Weather
HR	Hear; here	XCVR	Transceiver
HW	How	XMTR	Transmitter
K	Go ahead	XYL	Wife (ex-young-lady)
MSG	Message	YL	Young lady

Meaning of Q Signals

QRA	The name of my station is
QRL	Do not interfere, Frequency busy
QRM	Being interfered with
QRN	Static
QRO	Increase power, High power
QRP	Decrease power, Low power
QRQ	Send faster
QRR	I am ready for automatic operation
QRS	Send more slowly
QRT	Stop sending
QRU	I have nothing for you
QRX	I will call again at ..., wait
QRZ	Who is calling me, I am
QSB	Your signal is fading
QSD	Your keying is defective
QSK	I can hear you between my signals
QSL	I am acknowledging receipt
QSU	Reply on this frequency or mode
QSX	I am listening to ... on ... kHz
QSY	Change frequency, change to xmit on ... kHz
QTH	My location (home) is
QTR	The correct time is
QTS	I will send so my frequency can be measured
QUB	Here is the info you requested
QUM	The distress traffic has ended

Send a "?" after a Q signal to ask for information or an action.

Example: QRZ: station (call) is QRZ?: what is your station (call)?

Keyboard Key Functions

F1	Plays message 1.
F2	Plays message 2.
F3	Plays message 3.
F4	Plays message 4.
F5	Plays message 5.
F6	Plays message 6.
F7	Plays message 7.
F8	Plays message 8.
F9	Selects bank A.
F10	Selects bank B.
F11	Selects bank C.
F12	Selects bank D.
ALT+F1	Selects user 1.
ALT+F2	Selects user 2.
ALT+F3	Selects user 3.
ALT+F4	Selects user 4.
ALT+F5	Toggles monitor mode.
ALT+F6	Toggles keying output mode.
ALT+F7	Toggles queue mode.
ALT+F8	Enters carrier tune mode.
ALT+F9	Gets quick speed 1.
ALT+F10	Gets quick speed 2.
ALT+F11	Gets quick speed 3.
ALT+F12	Gets quick speed 4.
ALT+UP	Increases weight on the fly by 5%.
ALT+DOWN	Decreases weight on the fly by 5%.
ALT+LEFT	Decreases weight on the fly by 1%.
ALT+RIGHT	Increases weight on the fly by 1%.
BACK SPACE	Delete last character.
CTRL+BACK SPACE	Delete last word (only in message program mode).
LEFT	Decreases setting.
RIGHT	Increases setting.
DOWN	Decreases setting.
UP	Increases setting.
<	Decreases setting or enable prosign mode.
>	Increases setting or disable prosign mode.
\	Toggles prosign mode.
~	Enters command mode.
]	Ends message.
ENTER	Ends message if selected.
SPACE+/ 	Embedded command prefix.

PRINT SCREEN	Toggles displaying of the buffer memory.
PAUSE	Enters pause mode.
ESC	Purges keyboard buffer and exits any mode.
SHIFT+UP	Increases tone on the fly by 5 steps.
SHIFT+DOWN	Decreases tone on the fly by 5 steps.
SHIFT+LEFT	Decreases tone on the fly by 1 step.
SHIFT+RIGHT	Increases tone on the fly by 1 step.
CTRL+F1	Programs message 1.
CTRL+F2	Programs message 2.
CTRL+F3	Programs message 3.
CTRL+F4	Programs message 4.
CTRL+F5	Programs message 5.
CTRL+F6	Programs message 6.
CTRL+F7	Programs message 7.
CTRL+F8	Programs message 8.
CTRL+F9	Sets quick speed 1.
CTRL+F10	Sets quick speed 2.
CTRL+F11	Sets quick speed 3.
CTRL+F12	Sets quick speed 4.
CTRL+UP	Increases speed on the fly by 5 WPM.
CTRL+DOWN	Decreases speed on the fly by 5 WPM.
CTRL+LEFT	Decreases speed on the fly by 1 WPM.
CTRL+RIGHT	Increases speed on the fly by 1 WPM.
CTRL+B	Sets memory bank.
CTRL+C	Sets character space.
CTRL+D	Decrements serial number.
CTRL+E	Edits message memory.
CTRL+F	Sets Farnsworth mode.
CTRL+G	Sets word space.
CTRL+H	Enters hand-key mode.
CTRL+I	Sets iambic mode.
CTRL+J	Sets PTT hang time.
CTRL+K	Sets keying compensation.
CTRL+L	Sets keying delay.
CTRL+M	Sets monitor mode.
CTRL+N	Sets serial number.
CTRL+O	Sets output mode.
CTRL+P	Sets paddle mode.
CTRL+Q	Sets queue mode.
CTRL+R	Sets speed ratio.
CTRL+S	Sets overall speed.
CTRL+T	Sets sidetone frequency.

CTRL+U	Selects user.
CTRL+V	Reverses paddles.
CTRL+W	Sets weight.
CTRL+X	Enters carrier tune (xmit) mode.
CTRL+Y	Enters pulse tune mode.
CTRL+Z	Sets format for zeroes and nines.

Schematic

Menu Flow Chart